

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
21 May 2004 (21.05.2004)

PCT

(10) International Publication Number  
**WO 2004/042949 A1**

(51) International Patent Classification<sup>7</sup>: **H04B 1/76, 1/10**

(21) International Application Number:  
PCT/AU2003/001484

(22) International Filing Date:  
7 November 2003 (07.11.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
2002952566 7 November 2002 (07.11.2002) AU

(71) Applicant (for all designated States except US): **DSpace  
PTY LTD** [AU/AU]; Innovation House, First Avenue,  
Technology Park, Mawson Lakes, SA 5095 (AU).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **MICHAEL, Robert,  
Peake** [AU/AU]; Innovation House, First Avenue, Technol-  
ogy Park, Mawson Lakes, SA 5095 (AU).

(74) Agent: **ALLENS ARTHUR ROBINSON PATENT &  
TRADE MARKS ATTORNEYS**; Stock Exchange Cen-  
tre, 530 Collins Street, Melbourne, VIC 3000 (AU).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR,  
CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD,  
GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,  
KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,  
MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU,  
SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,  
UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

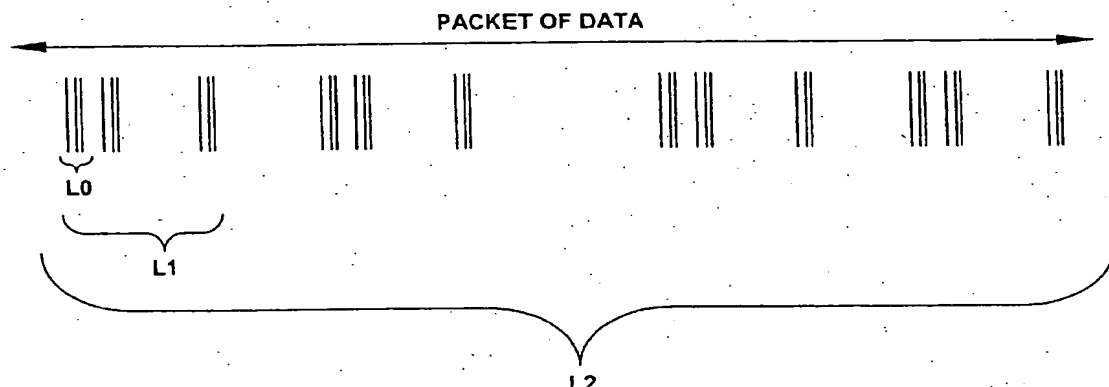
(84) Designated States (*regional*): ARIPO patent (BW, GH,  
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,  
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,  
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: **PILOT SYMBOLS IN COMMUNICATION SYSTEMS**



(57) **Abstract:** This invention relates to signal processing in telecommunications, particularly but not exclusively for use in wireless TDMA systems. In particular, the invention concerns methods for use in communication systems making use of pilot symbols. The invention provides a method of placing pilot symbols in a data stream for telecommunication systems, wherein the pilot symbols are spaced in time using a range of different intervals between symbols. The intervals between the pilot symbols are substantially fractal in nature, the distribution of pilot symbols involving repetitions of irregular groupings of pilot symbols in the data stream. Preferably, the irregular groupings of pilot symbols are irregularly spaced in the data stream. The invention also provides a method and means for acquiring the time and frequency offset of a packet of data by using pilot symbols distributed within the packet as defined above.

WO 2004/042949 A1